

Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants: Sophie Creux, *et al.*
Application No.: 10/560,068
Filing Date: June 5, 2006
Group Art Unit: 1782
Confirmation No.: 9849
Examiner: E. Cole
Title: Glass Fibres For Reinforcing Organic And/Or Inorganic
Materials, Composites Enclosing Said Fibres And Used
Compounds

Commissioner for Patents
Mail Stop Appeal Brief - Patents
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Dear Sir:

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. §41.37

In accordance with the provisions of 37 C.F.R. §41.37, Appellants submit the following Brief on Appeal.

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I. REAL PARTY IN INTEREST

The real party in interest in this appeal is OCV Intellectual Capital, LLC. Assignment of the application was recorded on February 13, 2008 at Reel 020505, Frame 0724.

II. RELATED APPEALS AND INTERFERENCES

There are no known appeals or interferences that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

The status of the claims is as follows:

Claims 1-6 and 8-20 are rejected, pending, and appealed.

Claim 7 is canceled.

IV. STATUS OF AMENDMENTS

The claim amendments presented in the Amendment After Final filed on March 5, 2010 in response to the final Office Action dated November 5, 2009 were entered. No further claim amendments have been proposed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

According to the features set forth in **claim 1**, a glass reinforcing yarn that contains, in percent by weight, 50-65% SiO₂, 12-20% Al₂O₃, 13-14.9% CaO, 6-12% MgO, 0-3% B₂O₃, 0-3% TiO₂, <2% Na₂O + K₂O, 0-1% F₂, and <1% Fe₂O₃ is provided. (*See, e.g.* page 1, lines 6-11 and page 3, line 14 to page 5, line 5). The glass reinforcing yarn contains no lithium oxide other than trace impurities. (*See, e.g.* page 6, lines 5-8). In addition, the glass reinforcing yarn has a specific Young's Modulus that is greater than 33. (*See, e.g.* page 2, lines 12-13, page 7, lines 3-5, and Table 1).

Claim 8 recites a glass composition suitable for producing glass reinforcing yarns that contains, in percent by weight, 50-65% SiO₂, 12-20% Al₂O₃, 13-14.9% CaO, 6-12% MgO, 0-3% B₂O₃, 0-3% TiO₂, <2% Na₂O + K₂O, 0-1% F₂, and <1% Fe₂O₃. (*See, e.g.* page 1, lines 6-11 and page 3, line 14 to page 5, line 5). The glass batch composition contains no lithium oxide other than trace impurities and has a specific Young's Modulus greater than 33. (*See, e.g.* page 2, lines 12-13; page 6, lines 5-8; page 7, lines 3-5; and Table 1).

Claim 14 recites a glass yarn that includes a composition containing, in weight percent, 50-65% SiO₂, 12-20% Al₂O₃, 13-14.9% CaO, 6-12% MgO, 0-3% B₂O₃, 0-3% TiO₂, <2% Na₂O + K₂O, 0-1% F₂, and <1% Fe₂O₃. (*See, e.g.* page 1, lines 6-11 and page 3, line 14 to page 5, line 5). The glass yarn has a specific Young's Modulus that is greater than 33. (*See, e.g.* page 2, lines 12-13, page 7, lines 3-5, and Table 1).

Mapping the separately argued claims to the specification:

Claim 1: A glass reinforcing yarn comprising a composition, expressed in percentages by weight of (page 1, lines 6-11 and page 3, line 14 to page 5, line 5):

| | |
|--------------------------------------|--|
| SiO ₂ | 50-65% (page 3, lines 14-31) |
| Al ₂ O ₃ | 12-20% (page 3, lines 14-25 and page 3, line 32 to page 4, line 7) |
| CaO | 13-14.9% (page 3, lines 14-25 and page 4, lines 8-9) |
| MgO | 6-12% (page 3, lines 14-25 and page 4, lines 10-13) |
| B ₂ O ₃ | 0-3% (page 3, lines 14-25 and page 4, lines 17-19) |
| TiO ₂ | 0-3% (page 3, lines 14-25 and page 4, lines 20-25) |
| Na ₂ O + K ₂ O | <2% (page 3, lines 14-25 and page 4, lines 26-30) |
| F ₂ | 0-1% (page 3, lines 14-25 and page 4, lines 31-34) |
| Fe ₂ O ₃ | <1% (page 3, lines 14-25 and page 5, lines 1-5) |

wherein the glass reinforcing yarn contains no lithium oxide other than trace impurities (page 6, lines 5-8), and has a specific Young's Modulus greater than 33 (page 2, lines 12-13, page 7, lines 3-5, and Table 1).

Claim 8: A glass composition suitable for producing glass reinforcing yarns, comprising, expressed in percentages by weight (page 1, lines 6-11 and page 3, line 14 to page 5, line 5):

| | |
|--------------------------------------|--|
| SiO ₂ | 50-65% (page 3, lines 14-31) |
| Al ₂ O ₃ | 12-20% (page 3, lines 14-25 and page 3, line 32 to page 4, line 7) |
| CaO | 13-14.9% (page 3, lines 14-25 and page 4, lines 8-9) |
| MgO | 6-12% (page 3, lines 14-25 and page 4, lines 10-13) |
| B ₂ O ₃ | 0-3% (page 3, lines 14-25 and page 4, lines 17-19) |
| TiO ₂ | 0-3% (page 3, lines 14-25 and page 4, lines 20-25) |
| Na ₂ O + K ₂ O | <2% (page 3, lines 14-25 and page 4, lines 26-30) |
| F ₂ | 0-1% (page 3, lines 14-25 and page 4, lines 31-34) |
| Fe ₂ O ₃ | <1% (page 3, lines 14-25 and page 5, lines 1-5) |

wherein the glass batch composition contains no lithium oxide other than trace impurities (page 6, lines 5-8), and has a specific Young's Modulus greater than 33 (page 2, lines 12-13, page 7, lines 3-5, and Table 1).

Claim 14: A glass yarn, comprising a glass composition containing the following constituents, in weight percent (page 1, lines 6-11 and page 3, line 14 to page 5, line 5):

| | |
|--------------------------------------|--|
| SiO ₂ | 50-65% (page 3, lines 14-31) |
| Al ₂ O ₃ | 12-20% (page 3, lines 14-25 and page 3, line 32 to page 4, line 7) |
| CaO | 13-14.9% (page 3, lines 14-25 and page 4, lines 8-9) |
| MgO | 6-12% (page 3, lines 14-25 and page 4, lines 10-13) |
| B ₂ O ₃ | 0-3% (page 3, lines 14-25 and page 4, lines 17-19) |
| TiO ₂ | 0-3% (page 3, lines 14-25 and page 4, lines 20-25) |
| Na ₂ O + K ₂ O | <2% (page 3, lines 14-25 and page 4, lines 26-30) |
| F ₂ | 0-1% (page 3, lines 14-25 and page 4, lines 31-34) |
| Fe ₂ O ₃ | <1% (page 3, lines 14-25 and page 5, lines 1-5) |

and having a specific Young's Modulus greater than 33 (page 2, lines 12-13, page 7, lines 3-5, and Table 1).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection to be reviewed are as follows:

- (1) Whether the subject matter of claims 1-6 and 8-13 comply with the written description requirement under 35 U.S.C. §112, first paragraph.
- (2) Whether the subject matter of claims 1-6 and 8-13 are indefinite under 35 U.S.C. §112, second paragraph.
- (3) Whether claims 1-6 and 8-20 are anticipated by, or, in the alternative, obvious over U.S. Patent Publication No. 2004/0092379 to Lewis ("Lewis") under 35 U.S.C. §102(a) and (e) and/or 35 U.S.C. §103(a).
- (4) Whether claims 1-6 and 8-20 are properly rejected under the provisional obviousness-type double patenting rejection over co-pending application USSN 11/722,039 to Lecomte ("Lecomte").

VII. ARGUMENTS

1. Enablement Rejection under 35 U.S.C. §112, first paragraph

With respect to the alleged lack of written description for the phrase “contains no lithium oxide other than trace impurities” in claims 1 and 8, Appellants respectfully submit that the phrase “contains no lithium oxide other than trace impurities” is supported by the application at least on page 6, lines 5-8, which recites that that “the molten glass feeding the bushings is obtained from pure batch materials or, more usually, natural batch materials (*i.e.*, those possibly containing trace impurities)”. It is respectfully submitted that these trace impurities may be derived from any number of sources and may include, for example, very small (*i.e.*, trace) amounts of lithium or lithium oxide. Indeed, it is virtually impossible to remove all trace elements from a glass composition. Appellants respectfully submit that the presence of “trace impurities”, such as the claimed trace impurities of lithium oxide, may, in fact, be present in the glass composition. Accordingly, it is respectfully submitted that the subject matter of claims 1 and 8 are supported by the original specification.

2. Indefiniteness Rejection under 35 U.S.C. §112, second paragraph

Appellants respectfully submit that the amended claims are definite under the standard set forth in the *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2007, §2173.02, namely, “[t]he essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. ... Some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire.”

Appellants respectfully submit that the phrase “trace impurities” is an art recognized phrase and is easily understood by those of skill in the art. As such, it is submitted that the phrase “trace impurities” needs no specific, recited definition within the application. Notwithstanding this implicit understanding, Appellants submit that the specification as filed teaches that “an impurity” of an element can be present in the composition in an amount from 0 to 0.6%. (*See* page 4, lines 21-22 of the specification). Thus, Appellants submit that the term “trace impurities” is not only understood by those of skill in the art, it is defined in the

application as being an amount from 0 to 0.6%. Accordingly, Appellants respectfully submit that independent claims 1 and 8, and all claims dependent therefrom, are sufficiently definite.

In the Advisory Action dated March 16, 2010, the Office asserts that “the discussion regarding trace impurities in the specification does not refer to lithium oxide or any general component, but refers to the amount of titanium oxide”. Appellants respectfully submit that the Office’s assertion is misplaced. It is clear from the description on page 6 of the application that the “trace impurities” are described generally and are not directed to titanium oxide. Indeed, titanium dioxide is not even mentioned in lines 5-8 of page 6. Thus, it is entirely conceivable that the trace impurities present in the batch composition could include lithium or lithium oxide as claimed by Appellants, since, as discussed above, the impurities may be derived from any number of sources.

In addition, the discussion on page 4, lines 21-22 of the application, although present within a discussion of the role of titanium dioxide, clearly teaches that “*an impurity*” is present in the composition in an amount from 0 to 0.6%. Appellants respectfully submit that the term “impurity” is, in fact, defined on page 4 as a content of a component in the composition in an amount from 0 to 0.6%, and is not restricted to any particular component, such as titanium dioxide.

3. Anticipation/Obviousness Rejection of Claims 1-6 and 8-20 Over Lewis

A. Office’s Position

The Office asserts Lewis teaches a glass composition for forming glass fibers that includes SiO₂, Al₂O₃, CaO, and MgO in amounts that at least anticipate the claimed invention. It is also asserted that Lewis teaches amounts of lithium oxide in a range of 0-9%. The Office admits that Lewis does not teach the T liquidus temperature, the claimed Young’s Modulus, or T log=4. However, it is asserted that since Lewis teaches a glass composition and yarn having the same components present and in the same amounts, it is reasonable to expect that the material of Lewis would possess the same properties.

B. Appellants’ Position

Appellants respectfully submit that the Office has incorrectly interpreted the cited reference and has therefore failed to establish a proper case of anticipation or a *prima facie* case of obviousness.

In particular, Appellants submit that Lewis does not teach or suggest a glass composition that has a CaO content from 13 to 14.9% as required by each of independent claims 1, 8, and 14. Appellants acknowledge that Lewis discloses a second generic glass composition that contains a broad range for CaO, namely from 3 to 15 wt%. (See the Table on page 3 positioned between paragraphs [0042] and [0043] of Lewis). However, Lewis also teaches a first generic glass composition that contains CaO in a range from 3.76 to 10.5 wt%. (See the Table on page 2 positioned between paragraphs [0029] and [0030] of Lewis). It is respectfully submitted that the range of 3.76 to 10.5 wt% is clearly outside the claimed range of 13 to 14.9%. Looking at each of the illustrative examples set forth in Lewis, it can be seen that *each and every* exemplary embodiment contains CaO in an amount much less than 13%. For instance, Example 1 contains 8.27 wt% CaO, Example 2 contains 7.71 wt% CaO, Example 3 contains 7.70 wt% CaO, Example 4 contains 9.61 wt% CaO, Example 5 contains 8.38 wt% CaO, Example 6 contains 6.74 wt% CaO, Example 7 contains 6.53 wt% CaO, Example 8 contains 6.74 wt% CaO, Example 9 contains 6.23 wt% CaO, Example 10 contains 5.28 wt% CaO, and Examples 11 and 12 each contain 6.70 wt% CaO. In addition, each of claims 1-20 recite a glass composition that contains CaO in an amount less than 13%.

Appellants respectfully submit that to evaluate the obviousness or non-obviousness of an invention, both the prior art reference(s) and the claimed invention as a whole must be considered. (See, e.g. *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 7, August 2008, §2141.02 citing *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983) and *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983)).

Looking at Lewis *as a whole*, Appellants submit that Lewis actually teaches the inclusion of CaO in an amount far less than the claimed amount of 13 to 14.9%. Indeed, in each of the disclosed “exemplary embodiments”, CaO is present in the glass composition in an amount less than or equal to 9.61 wt%. (See, e.g., Example 4 in paragraph [0033], which contains a maximum amount of 9.61 wt% CaO). Nowhere in Lewis is there any specific example (e.g. teaching) of the inclusion of CaO in an amount from 13 to 14.9% as required by each of claims 1, 8, and 14. Additionally, it is respectfully submitted that Lewis actually teaches away from the claimed amount of CaO. Appellants respectfully submit that one of skill in the art reading Lewis would be inclined to utilize CaO in an amount less than about

10 wt% CaO given that the largest amount of CaO present in the examples of Lewis is 9.61 wt%.

In addition, Appellants respectfully submit that there is no motivation for one of skill in the art to arrive at the glass reinforcing yarn of claim 1, the glass composition suitable for producing glass reinforcing yarns of claim 8, or the glass yarn of claim 14 based on the teaching of Lewis. In order to establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings, and the prior art reference (or references when combined) must teach or suggest all the claim limitations. (*See, e.g. Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 7, August 2008, §2143 citing *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007)).

It is respectfully submitted that one of ordinary skill in the art would have no motivation to formulate a glass composition that contains CaO in an amount from 13 to 14.9% based on the teaching of Lewis at least because Lewis specifically and clearly teaches the inclusion of CaO in an amount far less than the claimed amount of 13 to 14.9%, as is demonstrated by each of the disclosed “exemplary embodiments”. Indeed, it is respectfully submitted that CaO is present in the glass compositions of Lewis in amounts less than or equal to 9.61 wt% and that Lewis teaches away from the claimed compositions that contain CaO in an amount from 13 to 14.9%. Furthermore, Appellants submit that, looking at the teaching of Lewis as a whole, it would *not* be obvious to one of skill in the art to arrive at a glass composition that includes CaO in an amount from 13 to 14.9% as claimed in claims 1, 8, and 14. Appellants respectfully submit that without some teaching or suggestion, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

Additionally, Appellants agree with the Office that Lewis does not disclose the claimed Young's Modulus. (*See, e.g.*, page 3, lines 18-19 of the final Office Action dated November 11, 2009). Accordingly, it is respectfully submitted that claims 1, 8, and 14, and all claims dependent therefrom, are not anticipated by or obvious over Lewis for this additional reason.

In addition, Appellants respectfully submit that Lewis specifically teaches that the composition containing CaO in an amount from 3 to 15 wt% is utilized to form fiber

insulation blankets. (*See, e.g.* paragraph [0042] and the Table positioned between paragraphs [0042] and [0043] of Lewis). In contrast, the glass fibers formed by the inventive composition are reinforcing fibers, not fibers used to form insulation blankets. The fibers of the present invention can, for example, be used to form a reinforced composite product for use in aeronautical applications, for the reinforcement of helicopter blades, and to form optical cables. (*See, e.g.* page 6, lines 9-15; page 7, lines 10-13; and the Abstract of the present specification). Appellants submit that fibers forming an insulation blanket are simply not the same as fibers used to reinforce organic and inorganic materials. It is respectfully submitted that the use of a fiber suitable for use in an insulation blanket, such as is taught by Lewis, would be undesirable as a fiber reinforcement as it provides insufficient reinforcing properties. Indeed, a fiber of Lewis would render a reinforced composite useless for its intended purpose. Moreover, the Examples corresponding to the fibers used to form the insulation batts of Lewis did not contain an amount of CaO over 6.74%. (*See* Examples 8-12 on page 4 of Lewis). It is respectfully submitted that one of skill in the art reading Lewis would not arrive at the claimed invention because Lewis simply does not teach or suggest the claimed composition. Accordingly, Appellants submit that the fibers formed from the claimed composition are non-obvious and patentable for this additional reason.

Further, Appellants submit that Lewis does not teach or suggest the claimed amount of MgO. Appellants acknowledge that Lewis teaches a generic composition for glass fibers that includes MgO in an amount from 1.84 to 10.5 wt%. (*See* the Table positioned between paragraphs [0028] and [0029] of Lewis). However, each and every Example of Lewis contains an amount of MgO that is less than or equal to 4.71 wt%. (*See* Examples 1-12 on pages 2-4 of Lewis). Looking at Lewis *as a whole*, Appellants submit that Lewis actually teaches the inclusion of MgO in an amount far less than the claimed amount of 6 to 12%. Indeed, nowhere in Lewis is there any specific example (*e.g.* teaching) of the inclusion of MgO in an amount from 6 to 12% as required by each of claims 1, 8, and 14. Additionally, it is respectfully submitted that Lewis actually teaches away from the claimed amount of MgO. Appellants respectfully submit that one of skill in the art reading Lewis would be inclined to utilize MgO in an amount less than about 5 wt% MgO, *not* from 6 to 12% as claimed, especially given that the largest amount of MgO present in the examples of Lewis is 4.71 wt% (*see* Example 4 on page 2 of Lewis).

In view of the above, Appellants respectfully submit that one cannot reasonably interpret the teachings of Lewis to include a range of CaO or MgO that would render the claimed invention unpatentable. Accordingly, Appellants respectfully submit that Lewis does not teach or suggest the composition recited in claims 1, 8, and 14. Accordingly, it is submitted that a *prima facie* case of obviousness has not been established.

In sum, claims 1-6 and 8-20 stand rejected under 35 U.S.C. §102(a) and (e) as being anticipated by, or in the alternative, 35 U.S.C. §103(a) as being unpatentable over under U.S. Patent Publication No. 2004/0092379 to Lewis ("Lewis"). It is respectfully submitted that Lewis does not teach or suggest the claimed glass reinforcing yarn (claim 1), glass composition (claim 8), or glass yarn (claim 14). Accordingly, Appellants respectfully submit that the rejection of claims 1-6 and 8-20 as being anticipated by or obvious over Lewis should be reversed, thereby permitting claims 1-6 and 8-20 to be passed to allowance.

4. Provisional Obviousness-Type Double Patenting Rejection of Claims 1-6 and 8-20 over Co-Pending Application USSN 11/722,039 to Lecomte ("Lecomte")

Appellants respectfully submit that this rejection is premature as the copending application has yet to be fully examined and the pending claims have not yet been allowed. In this regard, Appellants respectfully request that this rejection be held in abeyance until the indication of allowable subject matter, upon which time Appellants would consider filing a Terminal Disclaimer.

VIII. CONCLUSION

Appellants hereby authorizes the Commissioner to charge payment or credit any overpayment of fees necessitated by the filing of this Brief on Appeal, including the statutory filing fee of \$540.00 and any necessary extensions of time required to maintain pendency of this application, to Assignee's Deposit Account No. 50-0568.

Respectfully submitted,

Date: May 20, 2010

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CLAIMS APPENDIX

CLAIMS ON APPEAL:

1. A glass reinforcing yarn comprising a composition, expressed in percentages by weight of:

| | |
|--------------------------------------|----------|
| SiO ₂ | 50-65% |
| Al ₂ O ₃ | 12-20% |
| CaO | 13-14.9% |
| MgO | 6-12% |
| B ₂ O ₃ | 0-3% |
| TiO ₂ | 0-3% |
| Na ₂ O + K ₂ O | <2% |
| F ₂ | 0-1% |
| Fe ₂ O ₃ | <1% |

wherein the glass reinforcing yarn contains no lithium oxide other than trace impurities and has a specific Young's Modulus greater than 33.

2. The glass yarn as claimed in claim 1, wherein the composition has an MgO+Al₂O₃ content of greater than 24%.

3. The glass yarn of claim 1, wherein the composition has an SiO₂+Al₂O₃ content of greater than or equal to 70%.

4. The glass yarn of claim 1, wherein the composition has an $\text{Al}_2\text{O}_3/(\text{Al}_2\text{O}_3+\text{CaO}+\text{MgO})$ weight ratio that varies from 0.40 to 0.44.

5. The glass yarn of claim 1, wherein the composition has a CaO/MgO weight ratio of greater than or equal to 1.40.

6. The glass yarn of claim 1 comprising, expressed in percentages by weight of:

| | |
|--|----------|
| SiO_2 | 56-61% |
| Al_2O_3 | 14-18% |
| CaO | 13-14.9% |
| MgO | 8-10% |
| B_2O_3 | 0-2% |
| TiO_2 | 0-2% |
| $\text{Na}_2\text{O} + \text{K}_2\text{O}$ | <0.8% |
| F_2 | 0-1%. |
| Fe_2O_3 | <0.8%. |

8. A glass composition suitable for producing glass reinforcing yarns, comprising, expressed in percentages by weight:

| | |
|-------------------------|----------|
| SiO_2 | 50-65% |
| Al_2O_3 | 12-20% |
| CaO | 13-14.9% |
| MgO | 6-12% |

| | |
|----------------|------|
| B_2O_3 | 0-3% |
| TiO_2 | 0-3% |
| $Na_2O + K_2O$ | <2% |
| F_2 | 0-1% |
| Fe_2O_3 | <1% |

wherein the glass batch composition contains no lithium oxide other than trace impurities and has a specific Young's Modulus greater than 33.

9. The composition as claimed in claim 8, wherein the composition has an $MgO+Al_2O_3$ content of greater than 24%.

10. The composition as claimed in claim 8, wherein the composition has an $SiO_2+Al_2O_3$ content of greater than or equal to 70%.

11. The composition as claimed in claim 8, wherein the composition has an $Al_2O_3/(Al_2O_3+CaO+MgO)$ weight ratio that varies from 0.40 to 0.44.

12. The composition as claimed in claim 8, wherein the composition has a CaO/MgO weight ratio of greater than or equal to 1.40.

13. The composition as claimed in claim 8, characterized in that the composition comprises the following constituents, expressed in percentages by weight of:

| | |
|---------|--------|
| SiO_2 | 56-61% |
|---------|--------|

| | |
|--|----------|
| Al_2O_3 | 14-18% |
| CaO | 13-14.9% |
| MgO | 8-10% |
| B_2O_3 | 0-2% |
| TiO_2 | 0-2% |
| $\text{Na}_2\text{O} + \text{K}_2\text{O}$ | <0.8% |
| F_2 | 0-1%. |
| Fe_2O_3 | <0.8%. |

14. A glass yarn, comprising a glass composition containing the following constituents, in weight percent:

| | |
|--|----------|
| SiO_2 | 50-65% |
| Al_2O_3 | 12-20% |
| CaO | 13-14.9% |
| MgO | 6-12% |
| B_2O_3 | 0-3% |
| TiO_2 | 0-3% |
| $\text{Na}_2\text{O} + \text{K}_2\text{O}$ | <2% |
| F_2 | 0-1% |
| Fe_2O_3 | <1% |

and having a specific Young's Modulus greater than 33.

15. The glass yarn of claim 14, wherein the glass yarn has a $T_{\log n=4}$ of between 1271 °C and 1298 °C.

16. The glass yarn of claim 14, wherein the glass yarn has a T_{liquidus} of between 1210 °C and 1280 °C.

17. The glass yarn as claimed in claim 14, wherein the composition has an $\text{MgO}+\text{Al}_2\text{O}_3$ content of greater than 24%.

18. The glass yarn as claimed in claim 14, wherein the composition has an $\text{SiO}_2+\text{Al}_2\text{O}_3$ content of greater than or equal to 70%.

19. The glass yarn as claimed in claim 14, wherein the composition has an $\text{Al}_2\text{O}_3/(\text{Al}_2\text{O}_3+\text{CaO}+\text{MgO})$ weight ratio that varies from 0.40 to 0.44.

20. The glass yarn as claimed in claim 14, wherein the composition has a CaO/MgO weight ratio of greater than or equal to 1.40.

EVIDENCE APPENDIX

None

PROCEEDINGS APPENDIX

None